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(54) **Novel acylamino acid compounds and a method for their production.**

(57) Novel N-acylamino acid compounds of the general formula (1) :

$$R\text{-}CO\text{-}(NH\text{-}X\text{-}CO)_n\text{-}OR^1 \quad (1)$$

are disclosed wherein (NH-X-CO) is an amino acid residue and X in (NH-X-CO) varies depending on the amino acid employed, R-CO is a saturated or an unsaturated fatty acid residue having from 6 to 24 carbon atoms, $R^1$ represents a hydrogen, sodium or potassium atom, or a methyl group and n is an integer of from 1 to 3, wherein at least one histidine is contained as a component amino acid. The compounds can be obtained by reacting an N-hydroxysuccinimide ester with an amino acid or a peptide.

The compound has antioxidizing, emulsifying, antibacterial and chelating properties, can absorb infrared radiation and display humidity-retaining properties.

EP 0 500 332 A2

This invention relates to novel N-acylamino acid compounds and a method for the production thereof. More particularly, it relates to novel compounds produced by acylating histidine and peptide containing histidine with a long-chain fatty acid and possessed of many functionalities such as antioxidizing power, emulsifying power, antibacterial power, chelating power, ultraviolet absorbing power, and humidity-retaining power and a method for the production thereof.

In recent years, the postulate that active oxygen induces various oxidizing reactions and constitutes itself a notorious cause for various diseases such as senility, arteriosclerosis, and cancers has come to be advocated and studies devoted to the development of an antioxidant capable of inhibiting the oxidizing reactions have been gaining in impetus. In the food industry, for example, such synthetic antioxidants as BHT (3,5-t-butyl-4-hydroxy toluene) and BHA (2,(3)-6-butyl-4-hydroxy anisole) are used as inexpensive and highly efficient antioxidants.

Since the detection of the carcinogenic action in these compounds, particularly in BHA, was reported, doubts have come to be cast on the safety of the compounds. Tocopherols which are used as naturally occurring antioxidants, in spite of their outstanding antioxidizing power, betray sparing solubility in water and liability to promote oxidation at a high concentration and, therefore, find only restricted utility in cosmetic preparations and foodstuffs. Other polyphenols which are possessed of an antioxidizing power fit only restricted applications on account of their weak point of exhibiting high solubility in water and sparing solubility in oil.

An object of this invention, therefore, is to provide novel acyl compounds and a method for the production thereof.

Another object of this invention is to provide novel compounds possessed of functionalities such as antioxidizing power, emulsifying power, antibacterial power, chelating power, ultraviolet absorbing power, and humidity-retaining power and a method for the production thereof.

These objects are accomplished by an N-acylamino acid compound represented by the general formula (1):

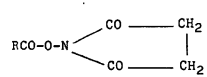
$$R\text{-}CO\text{-}(NH\text{-}X\text{-}CO)_n\text{-}OR^1 \qquad (1)$$

wherein (NH-X-CO) is an amino acid residue, X in (NH-X-CO) is variable with the kind of an amino acid to be used, R-CO is a saturated or unsaturated fatty acid residue having 6 to 24 carbon atoms, $R^1$ is hydrogen atom, sodium atom, potassium atom, or methyl group, and n is an integer in the range of from 1 to 3, indicating that at least one histidine is contained as a component amino acid.

These objects are further accomplished by a method for the production of an N-acylamino acid compound represented by the general formula (1):

$$R\text{-}CO\text{-}(NH\text{-}C\text{-}CO)_n\text{-}OR^1 \ (1)$$

wherein (NH-X-CO) is an amino acid residue, X in (NH-X-CO) is variable with the kind of an amino acid to be used, R-CO is a saturated or unsaturated fatty acid residue having 6 to 24 carbon atoms, $R^1$ is hydrogen atom, sodium atom, potassium atom, or methyl group, and n is an integer in the range of from 1 to 3, indicating that at least one histidine is contained as a component amino acid], characterized by causing an N-hydroxysuccinimide ester represented by the general formula (2):



(2)

wherein R-CO has the same meaning as defined above, to react with an amino acid or a peptide represented by the general formula (3):

$$H\text{-}(NH\text{-}X\text{-}CO)_n\text{-}OR^1 \qquad (3)$$

wherein (NH-X-CO), X, R-CO, $R^1$, and n have the same meanings as defined above, indicating that at least one histidine is contained as a component amino acid.

The objects are also accomplished by an antioxidant having as an active component thereof an N-acylamino acid compound represented by the general formula (1):

$$R\text{-}CO\text{-}(NH\text{-}X\text{-}CO)_n\text{-}OR^1 \qquad (1)$$

wherein (NH-X-CO) is an amino acid residue, X in (NH-X-CO) is variable with the kind of an amino acid to be used, R-CO is a saturated or unsaturated fatty acid residue having 6 to 24 carbon atoms, $R^1$ is hydrogen atom, sodium atom, potassium atom, or methyl group, and n is an integer in the range of from 1 to 3, indicating that at least one histidine is contained as a component amino acid.

The objects are further accomplished by an emulsifier having as an active component thereof an N-acylamino acid compound represented by the general formula (1):

$$R\text{-}CO\text{-}(NH\text{-}X\text{-}CO)_n\text{-}OR^1 \qquad (1)$$

wherein (NH-X-CO) is an amino acid residue, X in (NH-X-CO) is variable with the kind of an amino acid to be used, R-CO stands for a saturated or unsaturated fatty acid residue having 6 to 24 carbon atoms, $R^1$ is hydrogen atom, sodium atom, potassium atom, or methyl group, and n is an integer in the range of from 1 to 3, indicating that at least one histidine is contained as a component amino acid.

The N-acylamino acid compounds and the method for production thereof according to this invention are as described above and, therefore, are novel to the art. These compounds are novel antioxidants which exhibit an antioxidizing power in polar and nonpolar solvents. Further, these compounds are possessed of a very high emulsifying power and antibacterial power, chelating power, ultraviolet absorbing power, and warmth-retaining power as well and, therefore, are highly useful as raw materials for cosmetic goods, foodstuffs, medicines, etc.

## BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is an infrared absorption spectrum of N-oleoyl carnosine, i.e. an N-acyl peptide according to this invention,

Fig. 2 is an infrared absorption spectrum of N-oleoyl histidine, i.e. an N-acylamino acid according to this invention,

Fig. 3 is an infrared absorption spectrum of N-caprinoyl carnosine,

Fig. 4 is an infrared absorption spectrum of N-oleoyl carnosine methyl ester,

Fig. 5 is an infrared absorption spectrum of N-caprinoyl histidine,

Fig. 6 is an infrared absorption spectrum of N-oleoyl histidylleucine,

Fig. 7 is an infrared absorption spectrum of N-oleoyl glycylglycyl histidine,

Fig. 8 is a graph showing the antioxidizing power of N-acylamino acid compounds according to this invention,

Fig. 9 is graph showing the antioxidizing power of N-acylamino acid compounds according to this invention,

Fig. 10 is a graph showing the antioxidizing power of N-acylamino acid compounds according to this invention, and

Fig. 11 is a graph showing the antioxidizing power of N-acylamino acid compounds according to this invention.

The N-acylamino acids, N-acylpeptide compounds, salts thereof and methyl ester thereof which are contemplated by this invention (hereinafter referred to collectively as "N-acylamino acid compounds") are the compounds which are represented by the general formula (1), wherein R-CO is a saturated or unsaturated fatty acid residue having 6 to 24, preferably 9 to 20, carbon atoms. The fatty acid residues which answer this description include capryloyl ($C_8$), caprinoyl ($C_{10}$), lauroyl ($C_{12}$), myristoyl ($C_{14}$), palmitoyl ($C_{16}$), oleoyl ($C_{18:1}$), linoleoyl ($C_{18:2}$), linolenoyl ($C_{18:3}$), stearoyl ($C_{18}$), and arachidoyl ($C_{20}$), for example.

The part (NH-X-CO) of the general formula is an amino acid residue and the symbol X found in this part is variable with the kind of an amino acid to be used. The amino acids which are usable herein include histidine (His), glycine (Gly), tryptophan (Trp), isoleucine (Ile), phenylalanine (Phe), methionine (Met), cysteine (Cys), leucine (Leu), lysine (Lys), alanine, valine, proline, serine, threonine, tyrosine, asparagine, glutamine, arginine, aspartic acid, glutamic acid, beta-alanine, dopa, creatine, and ornithine (in the case of the amino acids having both D and L forms, they are usable in both forms), for example. Branched peptides are usable when they fulfil the aforementioned condition. (Of the amino acids cited above, those which are appended by a parenthesized abbreviation will be referred to hereinbelow by the relevant abbreviations.)

Then, n is an integer of 1 to 3, preferably 1 or 2, indicating that at least one His is contained as a component amino acid. The amino acid residue of (NH-X-CO), therefore, is a His residue when n is 1 or a peptide residue when n is 2 or 3. When n is 2, the amino acid residues which are available herein include -His-His, -Gly-His, -His-Gly, -His-Leu, -Leu-His, -Trp-His, -His-Trp, -Ile-His, -His-Ile, -Phe-His, -His-Phe, -Met-His, -His-Met, -Cys-His, -His-Cys, beta-3-methyl-L-His, gamma-aminobutylyl-L-His, and carnosine (beta-alanyl-L-His), for example. When n is 3, the amino acid residues available herein include -His-His-His, -Gly-His-Lys, -Gly-His-His, -Gly-Gly-His, -Ile-His-His, -Ile-Ile-His, -Phe-His-His, -Phe-Phe-His, -Met-His-His, -Met-Met-His, -Cys-His-His, -Cys-Cys-His, -Trp-His-His, and -Trp-Trp-His, for example.

The N-acylamino acid compounds of this invention are the compounds which contain the aforementioned fatty acid residues and amino acid residues as component elements, salts thereof, and methyl ester of the compounds. They particularly include N-capryroyl-His, N-capryroyl-His-His, N-capryroyl-His-Leu, N-capryroyl-Leu-His, N-capryroyl-beta-alanyl-3-methyl-L-His, N-capryroyl-gamma-aminobutylyl-L-His, N-capryroyl-carnosine, N-capryroyl-His-His-His, N-capryroyl-Gly-His-Lys, N-capryroyl-Gly-His-His, N-capryroyl-Gly-Gly-His, N-caprinoyl-His, N-caprinoyl-His-His, N-caprinoyl-His-Leu, N-caprinoyl-Leu-His, N-caprinoyl-beta-alanyl-3-methyl-L-His, N-caprinoyl-gamma-aminobutylyl-L-His, N-caprinoyl-carnosine, N-caprinoyl-His-His-His, N-caprinoyl-Gly-

His-Lys, N-caprinoyl-Gly-His-His, N-caprinoyl-Gly-Gly-His, N-lauroyl-His, N-lauroyl-His-His, N-lauroyl-His-Leu, N-lauroyl-Leu-His, N-lauroyl-beta-alanyl-3-methyl-L-His, N-lauroyl-gamma-aminobutylyl-L-His, N-lauroyl-carnosine, N-lauroyl-His-His-His, N-lauroyl-Gly-His-Lys, N-lauroyl-Gly-His-His, N-lauroyl-Gly-Gly-His, N-myristoyl-His, N-myristoyl-carnosine, N-palmitoyl-His, N-palmitoyl-His-His, N-palmitoyl-His-Leu, N-palmitoyl-Leu-His, N-palmitoyl-beta-alanyl-3-methyl-L-His, N-palmitoyl-gamma-aminobutylyl-L-His, N-palmitoyl-carnosine, N-palmytoyl-His-His-His, N-palmitoyl-Gly-His-Lys, N-palmitoyl-Gly-His-His, N-palmitoyl-Gly-Gly-His, N-oleoyl-His, N-oleoyl-His-His, N-oleoyl-His-Leu, N-oleoyl-Leu-His, N-oleoyl-beta-alanyl-3-methyl-L-His, N-oleoyl-gamma-aminobutylyl-L-His, N-oleoyl-carnosine, N-oleoyl-His-His-His, N-oleoyl-Gly-His-Lys, N-oleoyl-Gly-His-His, N-olaoyl-Gly-Gly-His, N-linoleyl-His, N-linoleyl-carnosine, N-linolenyl-His, N-linolenyl-carnosine, N-stearoyl-His, N-staaroyl-His-His, N-staaroyl-His-Lau, N-stearoyl-Lau-His, N-staaroyl-bata-alanyt-3-methyl-L-His, N-stearoyl-gamma-aminobutylyl-L-His, N-stearoyl-carnosine, N-stearoyl-His-His-His, N-stearoyl-Gly-His-Lys, N-stearoyl-Gly-His-His, N-stearoyl-Gly-Gly-His, N-arachidoyl-His, and N-arachidoyl-carnosine, for example.

The N-acylamino acid compound of this invention is obtained by causing an N-hydroxysuccinimide ester raprasantad by tha ganaral formula (2) to react with an amino acid or a paptida raprasented by the general formula (3) as described above.

This N-hydroxysuccinimide ester is obtained by causing a saturated or unsaturated fatty acid having 6 to 24 carbon atoms to react with an N-hydroxysuccinimide in an organic solvent such as, for example, ethyl acetate in the presence of a dichlorohexyl carbodiimide.

The N-acylamino acid compound is obtained easily in a high yield by causing this N-hydroxysuccinimide ester to react with an amino acid or a peptide in an organic solvent such as, for example, tetrahydrofuran under an alkaline condition at normal room temperature. In this reaction, the amount of the amino acid or peptide to be used is desired to be in the range of from 0.1 to 5 mols, preferably from 0.5 to 2 mols, per mol of the N-hydroxysuccinimide ester.

The alkaline condition is in the range of from pH 7 to pH 12, preferably from pH 8 to pH 11. The adjustment of this alkaline condition is obtained by the use of sodium carbonate, potassium carbonate, sodium hydrogen carbonate, or potassium hydrogen carbonate, for example.

The N-acyl-His and N-acyl-His-containing peptides [particularly N-acyl-carnosine (carnosine: beta-alanyl-L-His, which occurs in a high concentration in the brain and the muscles of man)] which are obtained as described above are amphipatic substances and are possessed of the following functionalities. For example, they are capable of repressing the speed of peroxidation of a higher fatty methyl ester in a nonaqueous hexane-isopropyl alcohol solution. When a liposome is formed of vital membrane as a model with egg yolk lecithin in an aqueous system and the oxidation reaction of the liposome is promoted with ferrous-ascorbate system, the N-acyl compound incorporated in the liposome in advance is capable of repressing the speed of this oxidation. Thus, it has been confirmed that the N-acyl-His and N-acyl-His-containing peptides (particulary N-acyl-carnosine) are possessed of the power of chelating an iron ion in addition to the antioxidizing power for curbing the formation of a peroxide. When these compounds were tested for emulsifying power in an oil-water system, they were found to have stronger emulsifying power under fixed set of conditions than such commercially available emulsifiers as casein, sugar ester, and Triton X100. It is quite evident that these compounds are possessed of the power to absorb ultraviolet light because they have numerous double bonds on the amino acid residue side.

Now, this invention will be described balow with raferance to working axamplas. It should ba notad, however, that the scope of this invention is not limited in any respect by these working examples.

Referential Example 1

In 130 ml of ethyl acetate, 3.45 g (30 m.mols) of N-hydroxysuccinimide was dissolved and then 3.45 g (30 m.mols) of oleic acid was dissolved. The resultant solution and a solution of 6.18 g (30 m.mols) of dicyclohexyl carbodiimide in 10 ml of ethyl acetate added thereto were stirred at normal room temperature with a magnetic stirrer and thus left reacting with each other for 15 hours. From the resultant reaction solution, about 7 g of the N-hydroxysuccinimida aster of olaic acid of high purity was obtainad by rapaatadly subjecting the reaction solution to tha traatmant for crystallization with athanol. Othar fatty acids can ba synthasizad and rafinad in tha same manner as described above.

Exampla 1

In 10 ml of water, 226 mg (1 m.mol) of carnosine and 84 mg (1 m.mol) of sodium hydrogen carbonate were dissolved. The resultant solution and a solution of 380 mg (1 m.mol) of the N-hydroxysuccinimide ester of oleic acid of high purity obtained in Reference Example in 10 ml of tetrahydroxyfuran added thereto were stirred at

normal room temperature with a magnetic stirrer and thus left reacting with each other for 15 hours. From the resultant reaction solution, about 200 mg of N-oleoyl-carnosine of high purity was obtained by acidifying the reaction solution with 6N hydrochloric acid, extracting the acidified reaction product from ethyl acetate, and repeatedly subjecting the extract to a treatment for crystallization with hexane/ethyl acetate (4 : 1 v/v). This N-oleoyl-carnosine was analyzed by IR, $^1$H-NMR, and $^{13}$C-NMR. In the infrared spectrum, the absorption peaks, region of 2,920 cm$^{-1}$ and 2,830 cm$^{-1}$ (CH expansion), originating in oleic acid and the absorption peaks, 1,650 to 1,400 cm$^{-1}$ (C=C, C=N expansion), originating in imidazole were discernible. Further, a marked decrease was found in the peak, 1,4580 cm$^{-1}$ (NH deformation), prominent in the chart of carnosine. In the $^1$H-NMR spectrum, a chemical shift of the $C_9$, $C_{10}$ cis-form proton in the magnitude of 5.30 ppm originating in oleic acid was discernible. The integral ratio implied the presence of an amide bond between an oleic acid and a carnosine. From the -COOH of oleic acid, the magnitude of chemical shift of the proton of carbon at the alpha position was found to have shifted from 2.30 ppm to 2.00 ppm and that of chemical shift of the proton of carbon at the beta position was found to have shifted from 1.60 ppm to 1.45 ppm. In the $^{13}$C-NMR spectrum, the magnitude of chemical shift of the carbon of -COOH of oleic acid was found to have shifted from 180.40 ppm to 170.59 ppm. These results indicate that the oleic acid formed an amide bond with the beta-alanine residue of carnosine. The infrared absorption spectrum is shown in Fig. 1.

Example 2

About 150 mg of N-oleoyl-His of high purity was obtained by following the procedure of Example 1. This compound was analyzed by infrared absorption spectroscopy. In the spectrum, the absorption peaks, region of 2,920 cm$^{-1}$ and 2,850 cm$^{-1}$ (CH expansion), originating in oleic acid and the absorption peaks, 1,650 to 1,400 cm$^{-1}$ (C=C, C=N expansion), originating in His were discernible. The structure of N-oleoyl-His was established by discernment of the absorption peaks, 3,400 to 3,100 cm$^{-1}$ (NH expansion), of amide. The infrared absorption spectrum of the N-oleoyl-His is shown in Fig. 2.

Examples 3-7

N-Caprinoyl carnosine (Example 3), N-Oleoyl carnosine methyl ester (Example 4), N-caprinoyl histidine (Example 5), N-oleoyl histidylleucine (Example 6), and N-oleoyl glycylglycylhistidine (Example 7) were prepared by a similar method to Example 1. Infrared absorption spectra were shown Fig. 3 (Example 3), Fig. 4 (Example 4), Fig. 5 (Example 5), Fig. 6 (Example 6), and Fig. 7 (Example 7).

With other peptides, corresponding N-acyl-peptides can be easily synthesized and their structures analyzed in the same manner us described above.

Example 8

The N-oleoyl-carnosine, N-caprinoyl-carnosine and N-oleoyl-carnosine methyl ester obtained respectively in Examples 1, 3 and 4 were tested for antioxidizing power in terms of repression of the radical chain autoxidation reaction of methyl linoleate. Hexane/isopropyl alcohol (1 : 1 v/v) containing 100 mM of methyl linoleate, 10 mM of an oil-soluble generating agent (2,2'-azo-bis(2,4-dimethyl valeronitrile)), and various concentration of N-oleoyl-carnosine, N-caprinoyl-carnosine or N-oleoyl-carnosine methyl ester was kept incubated at 37°C, sampled at intervals along the course of time, and analyzed by high-performance liquid chromatography to follow changes in the amount of methyl linoleate hydroperoxide to be formed. The results of the test shown in Fig. 8 clearly indicate that both of the compounds were possessed of antioxidizing power.

Example 9

Antioxidizing powers of N-oleoyl histidine and N-caprinoyl histidine obtained respectively in Examples 2 and 5 were determined by a similar method to Example 8 to find that they have antioxidizing powers as shown in Fig. 9.

Example 10

Antioxidizing powers of N-oleoyl histidylleucine and N-oleoyl glycylglycylhistidine obtained respectively in Example 6 and 7 were determined by a similar method to Example 8 to find that they have antioxidizing powers as shown in Fig.10.

Example 11

The N-oleoyl-carnosine and the N-oleoyl-histidine obtained respectively in Example 1 and Example 2 were tested for antioxidizing power in terms of the repression of the radical chain autoxidizing reaction of a multilayer liposome. A multilayer liposome was formed of 4 mM of egg yolk phosphatidylcholine, 0.4 mM of egg yolk phosphatidylcholine hydroperoxide, and 10 μM of N-oleoyl-carnosine or N-oleoyl-histidine by the use of 10 mM tris-hydrochloric acid buffer solution (pH 7.4). The multilayer liposome and 0.1 mM of ferrous sulfate and 1 mM of ascorbic acid added thereto were incubated at 37°C, sampled at intervals along the course of time, subjected to the TBA reaction to induce coloration of malondialdehyde resulting from the hydrolysis of lipid peroxide, and analyzed by high-performance liquid chromatography to follow changes in the amount of the hydrolyzate. The results of test shown in Fig. 11 indicate that the compounds were possessed of antioxidizing power and chelating power.

Example 12

The N-oleoyl-carnosine and the N-oleoyl-histidine obtained respectively in Example 1 and Example 2 were tested for emulsifying power. The emulsifying power was determined by dissolving each N-acyl compound in a concentration of 0.2% in 50 mM of phosphate buffer solution (pH 7), combining the resultant solution with one half in volume of soybean oil, subjecting the resultant mixture to a treatment with ultrasonic wave at 30°C, allowing the treated mixture to stand at rest at 30°C for a prescribed time, and measuring the turbidity of the lower layer consequently separated in the mixture in terms of O.D. (500 nm). The results of test shown in Table 1 indicate that N-oleoyl-carnosine and N-oleoyl-histidine were possessed of outstanding emulsifying power. The magnitudes of emulsifying power given in Table 1 represent relative numerical values of emulsifying power based on the emulsifying power of N-oleoyl-carnosine taken as 100.

Table 1

| Emulsifier | Relative emulsifying activity (%) |
|---|---|
| Tween 80 | 46.5 |
| Casein | 24.3 |
| Sugar ester | 19.4 |
| Triton X100 | 9.7 |
| N-oleoyl-His | 82.1 |
| N-oleoyl-carnosine | 100 |

**Claims**

1. An N-acylamino acid compound having the general formula (1):

$$R\text{-}CO\text{-}(NH\text{-}X\text{-}CO)_n\text{-}OR^1 \quad (1)$$

wherein (NH-X-CO) is an amino acid residue, X in (NH-X-CO) varies depending on the amino acid present, R-CO is a saturated or unsaturated fatty acid residue having from 6 to 24 carbon atoms, $R^1$ represents a hydrogen, sodium or potassium atom, or a methyl group, and n is an integer of from 1 to 3, wherein at least one histidine is present as a component amino acid.

2. A compound according to claim 1, wherein R-CO is a saturated or an unsaturated fatty acid residue having 8 to 20 carbon atoms.

3. A compound according to claim 1, wherein n is an integer of the value of 1 or 2.

4. A compound according to any of claims 1 to 3, wherein the amino acid is histidine, glycine, tryptophan, isoleucine, phenylalanine, methionine, cysteine, leucine, lysine, alanine, valine, proline, serine, threonine, tyrosine, asparagine, glutamine, arginine, aspartic acid, glutamic acid, beta-alanine, dopa, creatine, or

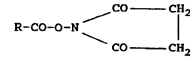
ornithine.

5. A compound according to any of claims 1 to 4, wherein the compound is N-oleoyl carnosine or N-oleoyl histidine.

6. A method for the production of an N-acylamino acid compound having the general formula (1):

$$R\text{-}CO\text{-}(NH\text{-}X\text{-}CO)_n\text{-}OR^1 \qquad (1)$$

wherein (NH-X-CO) is an amino acid residue, X in (NH-X-CO) varies depending on the amino acid present, R-CO is a saturated or unsaturated fatty acid residue having from 6 to 24 carbon,atoms, $R^1$ represents a hydrogen, sodium or potassium atom, or a methyl group, and n represents an integer of from 1 to 3, wherein at least one histidine is present as a component amino acid, the method comprising reacting an N-hydroxysuccinimide ester of the general formula (2):



(2)

wherein RCO has the same meaning as defined above with an amino acid or a peptide of the general formula (3):

$$H\text{-}(NH\text{-}X\text{-}CO)_n\text{-}OR^1 \qquad (3)$$

wherein (NH-X-CO), $OR^1$ and n have the same meanings as defined above.

7. A method according to claim 7, wherein the amount of amino acid or peptide is in the range of from 0.1 to 5 mols per mol of the N-hydroxysuccinimide ester.

8. A method according to claim 6 or 7, wherein the reaction is carried out at a pH of from 7 to 12.

9. A method according to any of claims 6 to 8 for preparing a compound according to any of claims 1 to 5.

10. An antioxidant or emulsifier having as an active component thereof an N-acylamino acid compound having the general formula (1):

$$R\text{-}CO\text{-}(NH\text{-}X\text{-}CO)_n\text{-}OR^1 \qquad (1)$$

wherein (NH-X-CO) is an amino acid residue, X in (NH-X-CO) varies depending on the amino acid present, R-CO is a saturated or an unsaturated fatty acid residue having from 6 to 24 carbon atoms, $R^1$ represents a hydrogen, sodium or potassium atom, or a methyl group, and n is an integer of from 1 to 3, wherein at least one histidine is present as a component amino acid.

11. An antioxidant or emulsifier according to claim 10 wherein the compound of formula (1) is as claimed in any of claims 2 to 5.

12. A cosmetic composition such as an ultra-violet radiation absorbing composition (such as a tanning or sun-blocking lotion) comprising a compound according to any of claims 1 to 5 and optionally a cosmetic carrier.

13. A foodstuff comprising a compound as claimed in any of claims 1 to 5, suitably in an anti-oxidizing effective amount.

14. A pharmaceutical composition, such as an antibacterial composition, comprising a compound according to any of claims 1 to 5 and a pharmaceutically acceptable carrier.

FIG.1

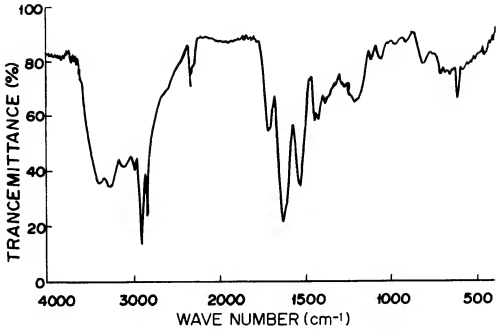

100
80
60
40
20
0
TRANCEMITTANCE (%)
4000
3000
2000
1500
1000
500
WAVE NUMBER (cm-1)

FIG.2

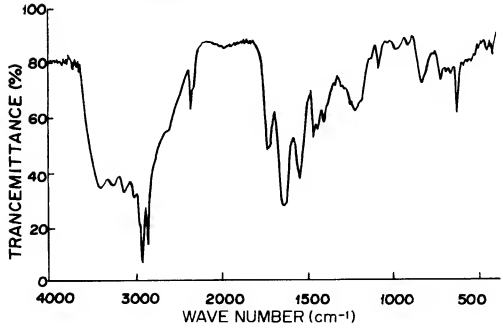

100
80
60
40
20
0
TRANCEMITTANCE (%)
4000
3000
2000
1500
1000
500
WAVE NUMBER (cm-1)

FIG. 3

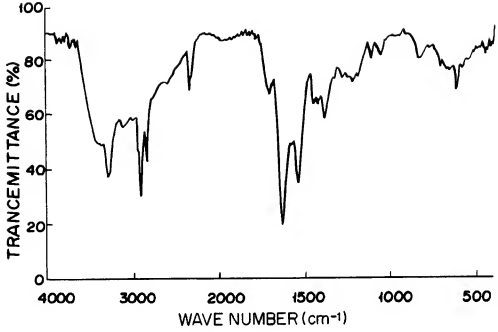

100
80
60
40
20
0
TRANCEMITTANCE (%)
4000
3000
2000
1500
1000
500
WAVE NUMBER (cm-1)

FIG. 4

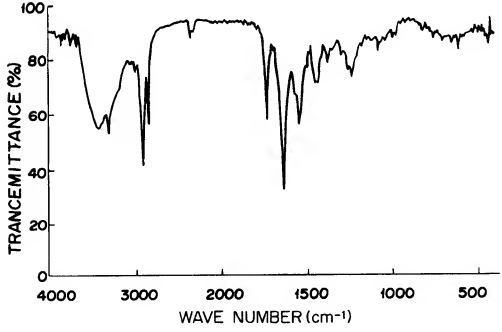

100
80
60
40
20
0
TRANCEMITTANCE (%)
4000
3000
2000
1500
1000
500
WAVE NUMBER (cm-1)

FIG.5

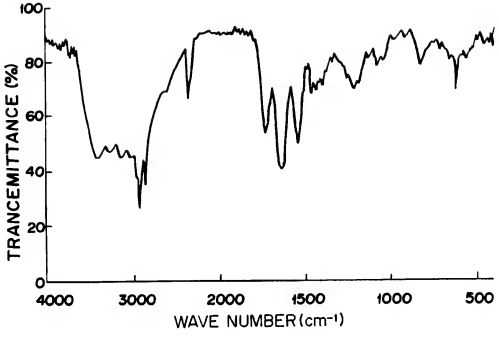

TRANCEMITTANCE (%)
100
80
60
40
20
0
4000
3000
2000
1500
1000
500
WAVE NUMBER(cm⁻¹)

FIG.6

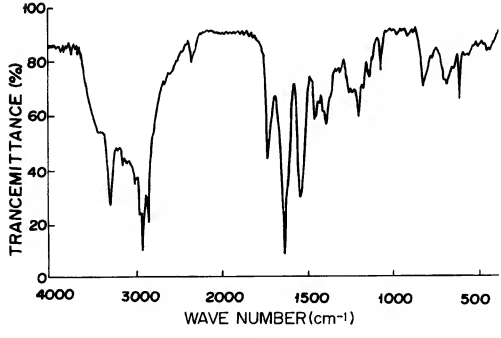

TRANCEMITTANCE (%)
100
80
60
40
20
0
4000
3000
2000
1500
1000
500
WAVE NUMBER(cm⁻¹)

FIG. 7

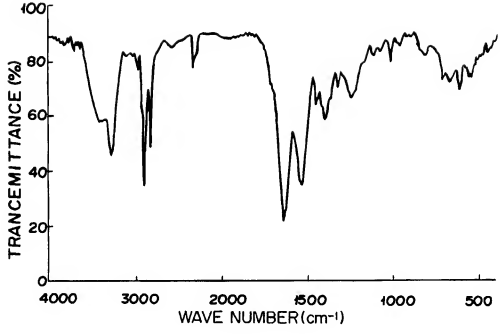
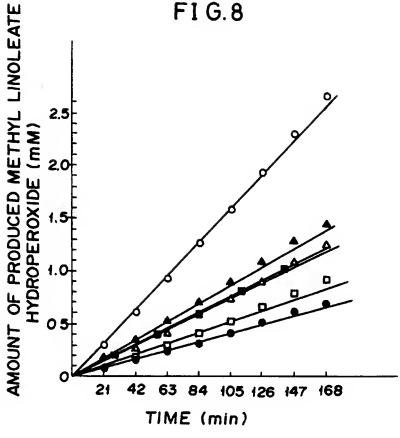

100
80
60
40
20
0
TRANCEMITTANCE (%)
4000
3000
2000
1500
1000
500
WAVE NUMBER(cm-1)

FIG.8




- ○ CONTROL
- ▲ 0.2 mM N-$C_{10}$-carnosine
- △ 0.2 mM N-$C_{18:1}$-carnosine
- □ 2.0 mM N-$C_{18:1}$-carnosine
- ● 10 mM N-$C_{18:1}$-carnosine
- ■ 0.2 mM N-$C_{18:1}$-carnosine methylester

FIG.9

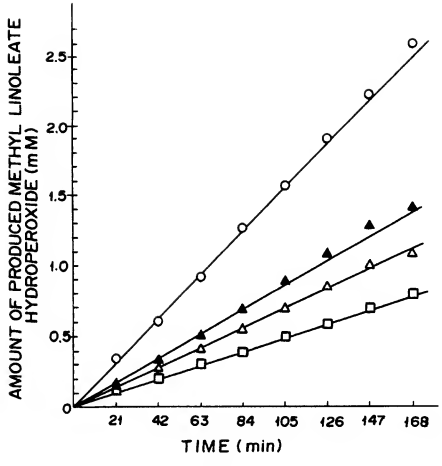
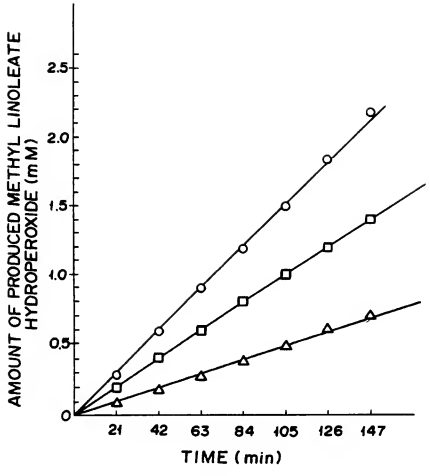

AMOUNT OF PRODUCED METHYL LINOLEATE HYDROPEROXIDE (mM)
2.5
2.0
1.5
1.0
0.5
0
21
42
63
84
105
126
147
168
TIME (min)
○ CONTROL
□ 2mM N-C18:1-His
△ 0.2mM N-C18:1-His
▲ 0.2mM N-C10-His

FIG. 10

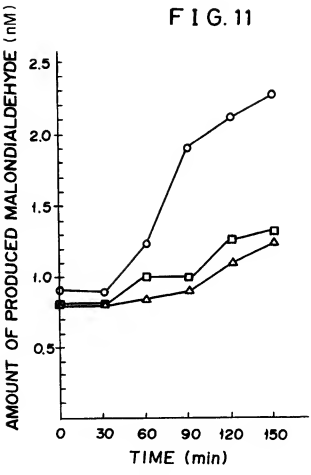



○ CONTROL

△ 0.2mM N−$C_{18:1}$−HisLeu

□ 0.2mM N−$C_{18:1}$−Gly Gly His

FIG. 11




○ CONTROL

□ 10μM N-oleoyl histidine

△ 10μM N-oleoyl carnosine